



StorageIO

**“The Green and Virtual Data Center”**  
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**Industry Trends and Perspectives:  
Challenges and Opportunities!**  
Greg Schulz, Founder & Sr. Analyst -The Server and StorageIO Group  
Email: [Greg@storageio.com](mailto:Greg@storageio.com) Blog: [storageioblog.com](http://storageioblog.com) or twitter @storageio  
Author “The Green and Virtual Data Center” (CRC)  
And “Resilient Storage Networks” (Elsevier)

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**Introduction**  
Who is Greg Schulz as well as Server and StorageIO?

- Independent IT Advisor/Analyst, Author, Blogger and Consultant
- Provide industry trends and perspectives on IT infrastructure topics
- Books, Articles, tips, reports, videos, podcasts appear globally



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**Follow-Up Reading**

**Industry Trend: Whats the Buzz(words)**  
Some Buzz Word Bingo topics, technologies, techniques

**B I N G O**

8 Gb Fibre Channel (8GFC), 10GbE, Agent-less, Authentication, Archiving, Backup, Backup Service Provider (BSP), BC/DR, Benchmarking, Blade servers, Bulk Storage, CAS, Capacity Planning, Capacity per watt, Converged Enhanced Ethernet (CEE), CIFS, Cloud Storage, Clustered Storage, CNA, Compliance, Compression, Converged Networks, DLP, D2D2D, Data management, Data migration, De-duplication, De-dupe debates, DPM, eDiscovery, Environmental Health and Safety (EHS), Encryption, Event Correlation, eWaste, Fibre Channel over Ethernet (FCoE), Federated, FRCP, File management, FLASH, Green, Grid, HA, I/O Virtualization (IOV), InfiniBand, Infrastructure Resource Management (IRM), IOPS per watt, IPM & MAID 2.0, iSCSI, Multi-Protocol Storage, Managed Service Provider (MSP), NAS, NFS, NPVID, Partitions, Policy Management, Power Cooling Floor-space EHS (PCFE), PCI SIG IOV, Performance, pNFS, Removable Hard Disk Drive (RHDD), RAID 6, Replication, RoHS, Replication, CDP, SAN, SAS, SATA, Security, Snapshots, SRM, SSD, Tape, Thin Provision, Tier 0, Unstructured data, VCB, Virtualization, Vmotion, VMware, VTL, WAAS, WADS, WAFS, WADM, Web 2.0, XaaS and many others...

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**Follow-Up Reading**

## Industry Trend: Compute Continuum

We Are In a Consolidation Phase (Again)...

Cell Phones, PDAs, Pocket PCs  
 Desktop PCs & Laptops  
 Mid-range & Servers  
 Mainframes

Converged Phones & Computers  
 From Desktop to Laptop x86 and VMs  
 From Proprietary to x86 & Hypervisors & Open  
 LPARs/VMs Open Networking Native Linux

Distribute Consolidate Distribute Consolidate Distribute

1950s 1960s 1970s 1980s 1990s 2000s 2010s

Service Bureau  
 Info Utilities  
 Out-source & In-source  
 xSPs Client Server  
 Software or Storage as a Service  
 Managed Service Providers  
 Grid, Cloud, Web 2.0

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**Follow-Up Reading**

## Industry Trend: Data Growth and Access

Productivity and agility drives need for processing speed

Characteristics and Functionality  
 Virtualized object based development and resources  
 Smaller, faster, more affordable, increased volume  
 Advanced operating and file system, GUI/UI  
 Advanced programming and development tools  
 Increased memory and processor capabilities  
 Physically smaller, more affordable and reliable  
 Applications need more processing capabilities  
 Compilers and programming languages  
 Interactive, online, and time sharing  
 Limited memory and processor constraints  
 Physically large, expensive capabilities  
 Assembler, machine code, batch processing

Web 2.0, SOA, SaaS  
 Virtualization and Massive Scaling  
 ISP, MSP, ISP, SSP  
 Web 1.0  
 Client server, GUIs  
 PCs, Internet  
 Minis Computers  
 LAN Servers  
 Mainframe  
 Batch

Cloud  
 Consolidate  
 Redistribute  
 Consolidation  
 Distributed Computing  
 Service Bureau  
 Highly Centralized

Compute Performance To Support Demand

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**Follow-Up Reading**

## Industry Trend: Demand Requires Density

The need for speed, faster, smaller, more efficient resources

Rich Media and Web Applications  
 Meeting Demand and Moore's Law

Source: Intel.com

MOORE'S LAW  
 The number of transistors on a microchip doubles approximately every two years, though the rate of growth has slowed in recent years.

Demand  
 Capability  
 Time

See "Data Center Performance Bottlenecks" [www.storageio.com](http://www.storageio.com)

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### Industry Trend: What's The Buzz?

No such thing as a data recession, Leverage what you have!

**In order to support demand:**  
Don't save as much data, limit expansion and QoS enhancements

**Or**

Leverage improved densities  
Remove IT footprint constraints

Boost efficiency, lower unit costs  
Improve performance

Do more with what you have  
Avoid compromise of QoS  
Enable agility and flexibility

**Available Resources**  
Performance, Availability, Capacity, Energy = PACE  
*E.g. Store and process more data in a denser footprint*

**QoS, Service Levels**  
Response Time, Availability

**Unit Cost of Resource**  
\$/ Capacity, \$ per IOP  
Capacity per watt, IOP per watt

Note: Innovation - Do and enable more with less without compromising customer service

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Follow-Up Reading

### Industry Trend: New Green IT (e.g. 2.0 ?)

Boosting IT efficiency & productivity, addressing PCFE and other IT issues

*Wheel of opportunity: PCFE optimization and IT productivity*

Policies, metrics, monitoring and best practices efficiency rebates

PCFE: Power, Cooling, Footprint, EH&S

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Follow-Up Reading

### Industry Trend: Boosting Efficiency

Expanding from Energy Avoidance to Energy Effectiveness

**Doing More with What Resources You Have Available!**

|   |  |
|---|--|
| <p><b>Energy Avoidance</b><br/>Power Down, Over Consolidate<br/>Decrease Amount of Useful Work<br/>Decrease Energy Used</p>           |  |
| <p><b>Some Energy Efficiency</b><br/>Faster Components, Same Power<br/>Increase Amount of Useful Work<br/>Same Amount Energy Used</p> |  |
| <p><b>Some Energy Efficiency</b><br/>Lower Power Draw Components<br/>Same Useful Work Done<br/>Decrease Energy Used</p>               |  |
| <p><b>More Energy Efficiency</b><br/>Faster Components/Less Power<br/>Increase Amount Useful Work<br/>Decrease Energy Used</p>        |  |

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Follow-Up Reading

## Industry Trend: Leveraging Density

Demand = More IT resources in a given footprint

**IT resources (Performance, Capacity, Availability, Energy)**

Available power & cooling per cabinet footprint threshold

1st Generation   2nd Generation   3rd Generation   4th Generation   5th Generation   6th Generation

Time  
Generation of IT equipment (Servers, storage, or networks)

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## Industry Trend: Next Generation Data Centers

What the "Information Factory" of the future looks like **Today!**

**New and Emerging**

- Scalable
- Flexible
- Resilient
- Secure
- Efficient

**Time Tested & Field Proven**

Balance of new and old technologies  
**Time (Performance) + Availability + Space (Capacity) + Economics**

|   |                                   |   |
|---|-----------------------------------|---|
| Public and Private Clouds<br>CDP, SSD and Dedupe<br>Thin provisioning, Virtualization<br>pNFS, FCoE and SAS | <b>Metrics</b>                    | Disk, Tape and Snapshots<br>RAID and Replication<br>Fibre Channel, iSCSI, NAS |
|   | Rates vs. Ratios<br>IOPs per watt |   |

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Follow-Up Reading

## Industry Trend: Virtualization (Next Wave)

Life beyond consolidation: Abstraction, emulate and agility

**Issues That Inhibit Consolidation:**

- QoS and performance barriers
- Politics and financial constraints
- Competitive or legal purposes
- Security and compliance

**Tomorrow**

Non-consolidated servers or storage

**A large market and IT virtualization opportunity!**

Total server and storage market size

**Action**

- Emulation
- Abstraction
- Aggregation
- Migration

Consolidated servers and storage using virtualization

**Today**

Consolidation applies only to a fraction of all servers or storage.

Market and IT opportunity = Life beyond consolidation

Using server or storage virtualization for IT resource management enabling abstraction and transparency for massive scaling, BC, DR & routine infrastructure resource management (IRM) operational functions

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## Industry Trend: Technology Alignment

Tiered IT Resources: What To Use When, Where and Why?



Just because a tool or technology will work does not mean it's the right fit for the given situation or environment all the time!

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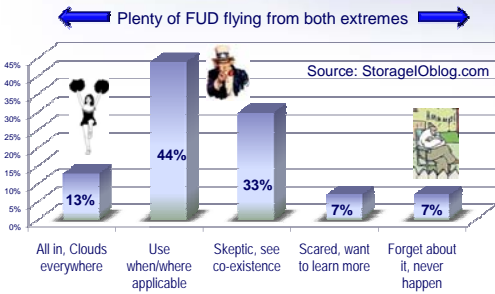
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## Industry Trend: What about clouds?

Various opinions, perspectives, opportunities and confusion



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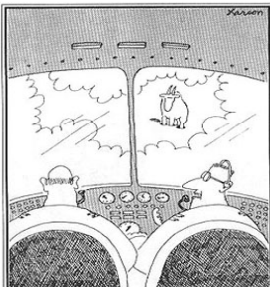
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Follow-Up Reading

## Industry Trend: Many Faces of IT Clouds

Cloudy weather & confusion vs. clear skies & opportunity



"Say... What's a mountain goat doing way up here in a cloud bank?"

### Many types of clouds

- Scientific vs. commercial
- Services vs. solutions
- Architecture vs. products
- Public vs. private
- Protocols and personalities

### Confusion and skepticism

- Lingering reminder of SSPs
- Replacement vs. complimentary
- BC/DR and availability

### Opportunities & call to action

- Clarify - Avoid flying blind
- Position as a IT tiered resource
- Complimentary vs. competitive
- Protect & preserve, part of BC/DR

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Follow-Up Reading

## Closing Comments

Where to learn more, next steps...

- Expanding your opportunities with Green IT
  - Identify and close the Green Gap
  - In addition to a focus on consolidating look at effectiveness
  - Look at how to boost productivity and profitability
  - Transition from energy avoidance to energy efficiency
  - Tiered servers, storage, networks, hypervisors and data protection
  - Cloud computing and storage are another tier of IT resources
  - Balance the old with the new, don't be afraid, look before you leap!
- Where to learn more
  - [www.storageio.com](http://www.storageio.com) articles, videos & webcasts
  - [www.storageioblog.com](http://www.storageioblog.com) and twitter @storageio
  - Feel free to call, IM, tweet, or email [greg@storageio.com](mailto:greg@storageio.com)

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Thank You

**Industry Trends and Perspectives:**  
*Challenges and Opportunities!*  
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